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December 15, 2004

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APPLICATION NUMBER: ***60/526,266***
FILING DATE: ***December 03, 2003***

By Authority of the
COMMISSIONER OF PATENTS AND TRADEMARKS

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Certifying Officer

13281 U.S.PTO

MAIL STOP PROVISIONAL PATENT APPLICATION
Attorney Docket No. 25858

19587 U.S.PTO
60/526266
120303

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Sami SAGOL

Serial No. Not yet assigned

Filed: December 3, 2003

Title: **INJECTED ARTICLE WITH METAL REINFORCING AND METHOD FOR ITS MANUFACTURE**

TRANSMITTAL LETTER

The Commissioner for Patents
Alexandria, Virginia 22313-1450

Sir:

Submitted herewith for filing in the U.S. Patent and Trademark Office is the following **PROVISIONAL APPLICATION:**

(1) Transmittal Letter
(2) Cover sheet for filing Provisional Application
(3) 19 page Provisional Application consisting of:
    9 pages Textual Specification
    4 pages of 28 claims
    0 pages containing the Abstract of the Disclosure
    6 sheets of drawings
(4) Check No. 19893 $ 160.00 for filing fee
(5) Postcard for early notification of serial number.

The Commissioner is hereby authorized to charge any deficiency or credit any excess to Deposit Account No. 14-0112.

Respectfully submitted,
NATH & ASSOCIATES PLLC

By: _____

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** Registered Patent Agent: not Admitted in DC

COVER SHEET FOR FILING U.S. PROVISIONAL APPLICATION UNDER 37 CFR 1.53(c)

Commissioner of Patents and Trademarks
Alexandria, Virginia 22313-1450

Re: New U.S. Provisional Patent Application
For: **INJECTED ARTICLE WITH METAL REINFORCING AND METHOD FOR ITS MANUFACTURE**
Inventors: Sami SAGOL; Hasharon, ISRAEL
Attorney Docket: 25858

Sir:

Attached hereto is the application identified above, including:

19 Pages Application Consisting of:
9 Pages of Textual Specification
4 Pages of 28 claims
0 Pages containing the Abstract of the Disclosure
6 Pages of Drawings
__ Executed Inventor's Declaration

The present provisional application names the following inventor(s): 1) Sami SAGOL; Hasharon, ISRAEL

The Government filing fee* is calculated as follows:
Base Fee (Provisional Application) . . . . . $ 160.00

TOTAL FILING FEE*
(accounting for possible small entity status) . . . $ 160.00

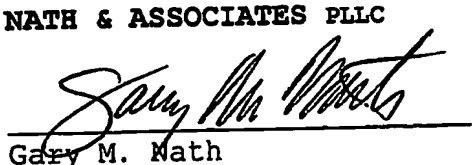
___ *Reduced by one-half, as applicant(s) is/are a "small entity".

_6_ Sheets of Drawing(s) is/are attached.

_X_ Submitted herewith is a check in the amount of $ 160.00. The Commissioner is hereby authorized to charge any deficiency or credit any excess to Deposit Account No. 14-0112.

Respectfully submitted,

NATH & ASSOCIATES PLLC



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INJECTED ARTICLE WITH METAL REINFORCING AND METHOD FOR ITS MANUFACTURE

FIELD OF THE INVENTION

This invention relates to composite articles made of injected plastic, more particularly to articles with metal reinforcing and methods of producing the same.

BACKGROUND OF THE INVENTION

SUMMARY OF THE INVENTION

According to the present invention, there is provided a composite article comprising a metal reinforcing element and injection-molded plastic coating firmly attached thereto. The reinforcing element is formed as an open channel having a longitudinal axis and an open side parallel to the axis. The plastic coating includes a portion formed as a wall mechanically closing the open side of the channel.

The form of the open channel preferably allows insertion of a rigid core snugly fitting the reinforcing element, through the open side of the channel, in the absence of the plastic coating. This manner of insertion provides great advantages in production, as shown below.

The reinforcing element may have various forms including at least one channel: two side walls and a transverse wall connecting them, a profile shaped as a truncated oval, two walls connected along a common edge, etc. The reinforcing element may comprise a plurality of open channels each of them being mechanically closed by a portion of the plastic coating. Alternatively, one or more channels of the reinforcing element may be left opened, thereby allowing plastic deformation of the article in the place of assembly. For example, a flat panel made

according to the present invention, having three open channels, may be bent into a rectangular column.

The metal reinforcing element preferably has openings providing better adhesion with the plastic coating. The openings may be through-going and the plastic coating may have protrusions with swollen heads at the inner side of the channel, obtained through said openings.

The metal reinforcing element may be made of one of the following: bent sheet metal, extruded metal profile, rolled metal profile.

The plastic coating preferably has closed tubular form embracing the metal reinforcing element. However, the plastic coating may include a second channel with open profile having two free edges fixed to two respective edges of the open channel of the metal reinforcing element.

The plastic coating may have a portion partially or fully covering the metal reinforcing element at the inner side of the channel. The plastic coating may also have openings in the closing wall or/and openings located so as to expose a portion of the metal reinforcing element.

The plastic coating may be made of the following materials:

thermoplast, polymerizing resin, polypropylene, polyacetal, polystyrene, with or without filling additives like fibers or chalk, or other flowable and settable materials that may be injection-molded, cast, or low-pressure molded.

According to another embodiment of the present invention, there is provided a flat constructive element comprising at least two composite articles as described above. These composite articles are parallel elongated beams connected by transverse beams formed from the same injection-molded plastic as the composite articles. The parallel elongated beams and said transverse beams are preferably integrally formed from the same injection-molded plastic.

The transverse beams preferably have open profiles with an open side oriented in the same direction. The metal reinforcing elements in the elongated beams are preferably oriented with their open side in the same direction as the open profiles of the transverse beams.

According to a further embodiment of the present invention, there is provided a composite article as described above, having at one end thereof an extension of the injection-molded plastic coating. The external shape of the extension allows tight insertion of the extension into the channel of a similar composite article, in the direction of the channel axis.

According to a second aspect of the present invention, there is provided a method for manufacturing the above-described composite article, including:

- providing the metal reinforcing element;

- providing the rigid core;

- providing an injection mold comprising at least two parts formed to define a mold cavity therebetween when the mold is assembled, the mold being adapted to accommodate the metal reinforcing element fixedly in the cavity, allowing space for the plastic coating;

- inserting the rigid core in the metal reinforcing element via the open side, so that the core snugly fits the channel;

- assembling the mold parts and the metal reinforcing element with the inserted core therein so as to fix the reinforcing element in the cavity of the mold;

- injecting flowable and settable plastic coating into the space to form the composite article;

- releasing the obtained article including the reinforcing element, the set plastic coating and the core, by disassembling the mold; and

- removing the rigid core from the composite article in direction along the channel axis.

Preferably, the assembling of the mold parts and the metal reinforcing element is done by relative motion thereof transverse to the channel axis.

The mold parts preferably have a plurality of protrusions adapted to abut the metal reinforcing element when the mold is assembled, thereby fixing the reinforcing element in the mold cavity. The protrusions may be relatively wide and may have rounded edges so as to form in the plastic coating decorative windows visibly exposing the surface of the metal reinforcing element.

When the reinforcing element has through openings for better adhesion to the plastic coating, the rigid core may have recesses located opposite the openings when the core is inserted in the reinforcing element, so that the injected plastic coating can form protrusions with swollen heads at the inner side of the channel.

The rigid core may be assembled from two or more parts divided along the channel so as to facilitate the removing of the core in direction parallel to the channel axis.

The composite article of the present invention presents numerous advantages in production, functionality and maintenance:

- strength and stability at extremely low weight due to the thin metal profiles, the thin plastic coating and the closed tubular form of the article;
- possibility to employ open metal profiles such as bent, rolled and extruded profiles which are readily available and cheap in production;
- usage of the well known and developed technology of injection-molding;
- fast and efficient mold assembly;
- possibility to employ various types of plastics such as thermosetting and thermocondensing resins, as mentioned above, with good adhesion to metal;
- possibility to obtain a variety of composite profiles;
- possibility to design various constructive modules based on the composite article;
- possibility to achieve various decorative effects by exposing parts of the reinforcing element.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to understand the invention and to see how it may be carried out in practice, a preferred embodiment will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

Fig. 1 is a cross-sectional view of the basic composite article of the present invention.

Fig. 2 shows three variations of the cross section of the basic composite article.

Fig. 3 shows a composite article with partially coated internal surface of the reinforcing element.

Fig. 4 shows a composite article with non-closed plastic coating.

Fig. 5 shows composite articles with multiple channels and rolled or extruded reinforcing elements.

Fig. 6 shows composite articles with multiple channels and bent or extruded reinforcing elements.

Fig. 7 shows perspective views of a shelf-and-pillar assembly based on the composite article of the present invention.

Fig. 8 is a close-up view of a section through a beam of the shelf of Fig. 7.

Fig. 9 is a perspective view of two modular supports based on the composite article of the present invention.

Figs. 10 A, B, C and **D** illustrate the process of production of the composite article.

Fig. 11 shows a mold core composed of four parts for production of the composite article.

DETAILED DESCRIPTION OF THE INVENTION

With reference to Fig. 1, there is shown the cross-section of a composite article 10 of the present invention. The article includes a metal reinforcing profile 12 and injection-molded plastic coating 14 firmly attached to the metal in the process of injection molding. The reinforcing profile 14 has the form of an open channel 16 having a longitudinal axis O and an open side S parallel to the axis. The plastic coating 14 includes a portion formed as a wall 18 mechanically closing the open side S of the channel. The form of the open channel 16 allows insertion of a rigid mold core 20 snugly fitting the reinforcing profile 12, through the open side S before the injection-molding (see also Fig. 10A). Insertion transverse to the channel axis provides great advantages in production, as shown below. The core 20 need

not fill the whole internal space of the channel 16 or fit tightly along the whole internal surface thereof. The snug fit means that the core 20 provides mechanical stability to the walls of the reinforcing profile 12 against the pressure during injection molding and prevents leakage of the liquid plastic towards the internal surface of the profile 12.

The composite article of the present invention may provide a variety of forms including various reinforcing profiles. Fig. 2 shows variations of the basic form in Fig. 1, such as truncated oval 22 (C-shape), triangle 24 based on L-profile 26, and a profile with swollen head 28. The latter shows that the mold core 20 may support the reinforcing profile only in separate places along the circumference. The profile 28 has through-going holes 32 receiving the injected plastic for better adhesion. The plastic material may be formed with heads 30 at the inner side of the reinforcing profile (see Fig. 4).

The inner surface of the reinforcing profile may be partially covered with plastic coating 33 as shown in Fig. 3. Alternatively, the plastic coating may not form a closed tube but an open channel, as shown in Fig. 4, where the free edges 36 of the reinforcement profile 12 and the free edges 38 of the plastic coating 34 are firmly fixed to each other to close the profile of the composite article.

The composite article of the present invention may comprise more than one closed channel. For example, Fig. 5 (a) shows article 40 with triangular section injection-molded over a T-profile 42, having two channels. Fig. 5 (b) shows article 45 with rectangular section injection-molded over an H-profile 48, also having two channels.

Fig. 6 shows more examples of composite articles comprising a reinforcing element with a plurality of open channels. Each open channel is mechanically closed by a portion of the plastic coating. Alternatively, if one or more channels of the reinforcing element are left opened, then the article may be bent after molding, by plastic deformation of the metallic reinforcing element. For example, if a flat panel like the one in Fig. 6(b) is be made with more channels, three of them being open, then it may be bent into a rectangular column in the place of assembly. If

more channels on one side of the panel are left open, then the panel may be rolled into a polygonal or round column, etc.

The metal reinforcing profile may be made of bent sheet metal, extruded metal profile or rolled metal profile. It would be appreciated that profiles in Fig. 5 can be made of rolled metal, while profiles in Figs. 4 and 6 would be more conveniently made of bent metal sheet. The latter is especially advantageous since the reinforcing profile may be made of quite thin sheet, for example 0.5 mm steel. Such sheet may be easily bent, punched or pressed, yet it provides remarkable structural strength for the applications (shelves and supports) shown below, due to the closed form of the profile which is obtained by the closing plastic wall.

The plastic coating is also relatively thin, about 2-3 mm. It may also have openings in the closing wall or/and openings located so as to expose a portion of the metal reinforcing profile. It may be made of thermoplasts or polymerizing resins, such as polypropylene, polyacetal, polystyrene, with or without filling additives like fibers or chalk, or other flowable and settable materials that may be injection-molded, cast, or low-pressure molded.

The composite articles of the present invention can be suitably incorporated in various constructive elements and products. With reference to Figs. 7A and 7B, and the close-up view in Fig. 8, there is provided a flat constructive element (shelf) 50 comprising two parallel carrying elongated beams 52 which constitute composite articles as described above, having reinforcing profiles 54 and injection-molded plastic coating 56. The beams 52 are connected by transverse beams 58 formed integrally from the same injection-molded plastic as the beams 52. It would be appreciated that, in order to manufacture the shelf 50 by single injection-molding, it is preferable to design the transverse beams 58 as open profiles with an open side oriented towards one side of the shelf to dispose the metal reinforcing profiles 54 with their open side in the same direction.

With reference to Fig. 9, there is shown another constructive element, a modular support 60 constituting a composite article as described above. The modular support 60 has an extension 62 of the molded plastic coating at one end.

The external shape of the extension 62 allows tight insertion into the channel 64 of a similar support 60', in the direction of the channel axis. Thus, a number of shelves 50 can be assembled with multiple modular supports 60 to form a rigid, stable and light-weight storage rack.

With reference to Figs. 10A, B, C and D, there is shown a method for manufacturing the above-described composite article by injection-molding. According to the method, first, the rigid mold core 20 is inserted in the prepared metal reinforcing profile 12, so that the core snugly fits the channel 16. The insertion is done through the open side of the channel, transversely to the channel axis.

Second, the metal reinforcing profile 12 with the inserted core 20 is assembled with an injection mold 70. The injection mold comprises two parts 71 and 72 formed to define a mold cavity 74 when the mold 70 is assembled. The mold 70 is designed to accommodate the metal reinforcing profile 12, allowing space 76 for the plastic coating. The reinforcing element 12 is fixed in the cavity of the mold by means of protrusions 78 abutting the metal reinforcing profile and the mold core 20.

Third, flowable plastic composition is injected through channels 79 into the space 76 to form the composite article and is then subjected to curing, cooling, etc. by a process known *per se* in the art of injection molding.

Fourth, the mold 70 is disassembled and the obtained article 10 is released. At this stage, the article 10 includes the reinforcing profile 12, the set plastic coating 14, and the mold core 20.

Last, the rigid core 20 is removed from the composite article 10 in direction along the channel axis.

The fixing protrusions 78 may be relatively wide, so as to form in the plastic coating decorative windows 81 visibly exposing the surface of the metal reinforcing profile (see also Fig. 8).

With reference to Fig. 11, the mold core 20 may have recesses 83 located opposite the openings 32 in the reinforcing profile 12, so that the injected plastic

coating can form protrusions with swollen heads at the inner side of the channel. In such case, the mold core 20 may be assembled from two or more parts 20a, 20b, etc., divided along the channel axis so as to facilitate the removal of the core 20 in direction parallel to the channel axis.

It will be appreciated that the above method of production of the composite article allows combining the strength and stability of shell structures based on closed profiles geometry, the availability and cheapness of the thin metal open profiles, and versatility, durability and decorative properties of injection-molded plastics. Especially advantageous is the fast and efficient mold and core assembly and mold disassembly in direction perpendicular to the article axis which allows very fast production cycles.

The composite structure of the article allows designs without bulky volumes of plastic material and thus avoiding sink marks which characteristically appear at the base of structural ribs in all-plastic articles after setting.

Although a description of specific embodiments has been presented, it is contemplated that various changes could be made without deviating from the scope of the present invention. Other configurations of the reinforcing profile and the composite article may be readily derived from Fig. 6. For example, a multi-channel composite profile may have non-closed channels allowing elastic and/or plastic deformation and obtaining various cross-sections after the molding.

CLAIMS:

1. A composite article comprising a metal reinforcing element and injection-molded plastic coating firmly attached thereto, wherein said reinforcing element is formed to define an open channel having a longitudinal axis and an open side parallel to said axis, and said plastic coating includes a portion formed as a wall mechanically closing said open side of the channel.

2. The composite article according to Claim 1, wherein the form of said open channel allows insertion of a rigid core snugly fitting said reinforcing element, the insertion being through said open side, in the absence of said plastic coating.

3. The composite article according to Claim 2, wherein said reinforcing element has two side walls and a transverse wall connecting said side walls.

4. The composite article according to Claim 2, wherein said reinforcing element has a profile shaped as a truncated oval.

5. The composite article according to Claim 2, wherein said reinforcing element comprises two walls connected along a common edge.

6. The composite article according to Claim 1, wherein said metal reinforcing element has openings providing better adhesion with said plastic coating.

7. The composite article according to Claim 6, wherein said openings are through-going and said plastic coating has protrusions with swollen heads at the inner side of the channel, obtained through said openings.

8. The composite article according to Claim 1, wherein said metal reinforcing element is made of one of the following: bent sheet metal, extruded metal profile, rolled metal profile.

9. The composite article according to Claim 1, wherein said plastic coating has closed tubular form embracing said metal reinforcing element.

10. The composite article according to Claim 1, wherein said plastic coating has a form including a second channel with open profile having two free edges, said two free edges being fixed to two respective edges of the open channel of said metal reinforcing element.

11. The composite article according to Claim 1, wherein said metal reinforcing element is formed to define a plurality of open channels each of them being mechanically closed by a wall which is a portion of said plastic coating.

12. The composite article according to Claim 1, wherein said plastic coating has a portion at least partially covering said metal reinforcing element at the inner side of said channel.

13. The composite article according to Claim 1, wherein the closing wall formed by said plastic coating has at least one opening.

14. The composite article according to Claim 1, wherein said plastic coating has at least one opening located so as to expose a portion of said metal reinforcing element.

15. The composite article according to Claim 1, wherein said plastic coating is at least one of the following materials:

thermoplastic, polymerizing resin, polypropylene, polyacetal, polystyrene.

16. A flat constructive element comprising at least two composite articles as described in Claim 1, wherein said articles are parallel elongated beams connected by transverse beams formed from the same injection-molded plastic as said composite articles.

17. The flat constructive element of claim 16, wherein said parallel elongated beams and said transverse beams are integrally formed from the same injection-molded plastic.

18. The flat constructive element of claim 16, wherein said transverse beams have open profiles with an open side oriented in the same direction.

19. The flat constructive element of claim 18, wherein the metal reinforcing elements of said elongated beams are oriented with their open side in the same direction as the open profiles of said transverse beams.

20. The composite article according to Claim 1, having at one end thereof an extension of said injection-molded plastic coating with external shape allowing tight insertion of said extension into the channel of a similar composite article, in the direction of said channel axis.

21. A method for manufacturing the composite article of Claim 1, where the form of said metal reinforcing element allows insertion, via the open side of the channel, of a rigid core snugly fitting said reinforcing element, the method including:

- providing said metal reinforcing element;

- providing said rigid core;

- providing an injection mold comprising at least two parts formed to define a mold cavity therebetween when the mold is assembled, said mold being adapted to accommodate said metal reinforcing element fixedly in said cavity, allowing space for said plastic coating;

- inserting said rigid core in said metal reinforcing element via said open side, so that said core snugly fits said element;

- assembling said mold parts and said metal reinforcing element with the inserted core therein so as to fix said reinforcing element in the cavity of said mold;

- injecting flowable and settable plastic coating into said space to form said composite article;

- releasing the obtained article including the reinforcing element, the set plastic coating and said core, by disassembling said mold; and

- removing said rigid core from said article in direction along said channel axis.

22. The method according to Claim 21, wherein the assembling of said mold parts and said metal reinforcing element is done by relative motion thereof transverse to said channel axis.

23. The method according to Claim 21, wherein said mold parts have a plurality of protrusions adapted to abut said metal reinforcing element when said mold is assembled, thereby fixing the reinforcing element in said mold cavity.

24. The method according to Claim 23, wherein at least part of said protrusions are relatively wide and have rounded edges so as to form in said plastic coating decorative windows visibly exposing the surface of said metal reinforcing element.

25. The method according to Claim 21, wherein said reinforcing element has openings and said injected plastic coating fills them providing better adhesion.

26. The method according to Claim 25, wherein said rigid core has recesses which are located opposite said openings when said core is inserted in said reinforcing element, so that said injected plastic coating can form protrusions obtained through said openings, said protrusions having swollen heads at the inner side of the channel.

27. The method according to Claim 21, wherein said rigid core is assembled from at least two parts divided along the channel so as to facilitate the removing of said core in direction parallel to the channel axis.

28. The composite article according to Claim 1, wherein said metal reinforcing element is formed to define a plurality of open channels, some of them being mechanically closed by a wall which is a portion of said plastic coating, so as to allow bending of said composite article along the rest open channels.

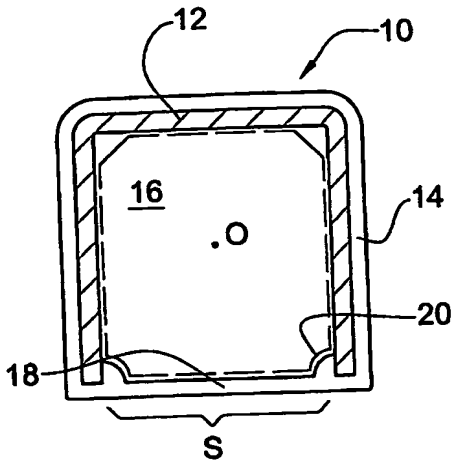

FIG. 1

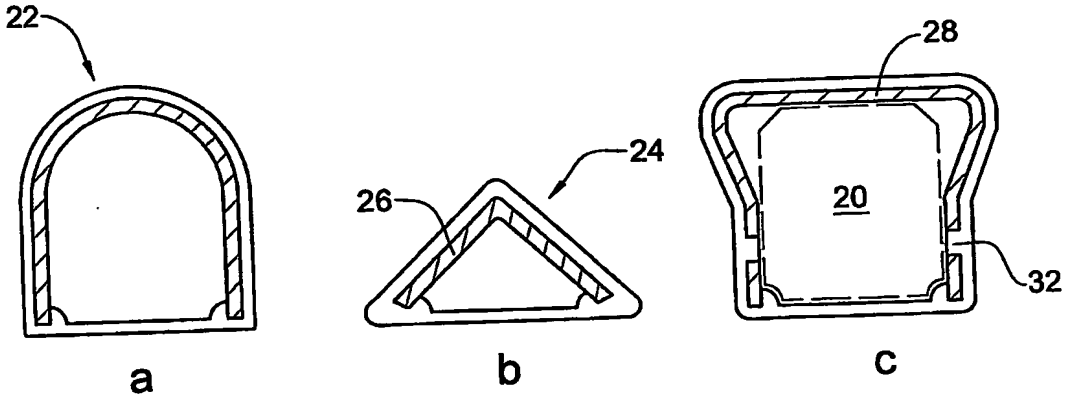

FIG. 2

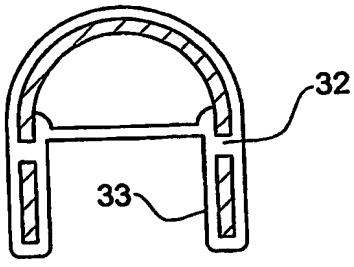

FIG. 3

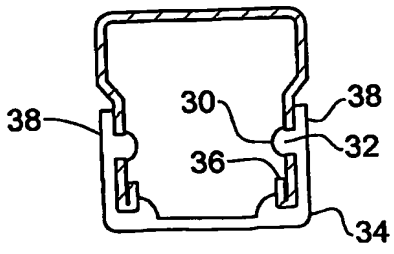

FIG. 4

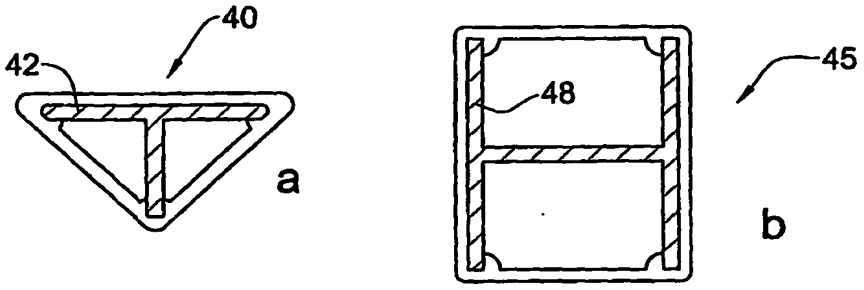

FIG. 5

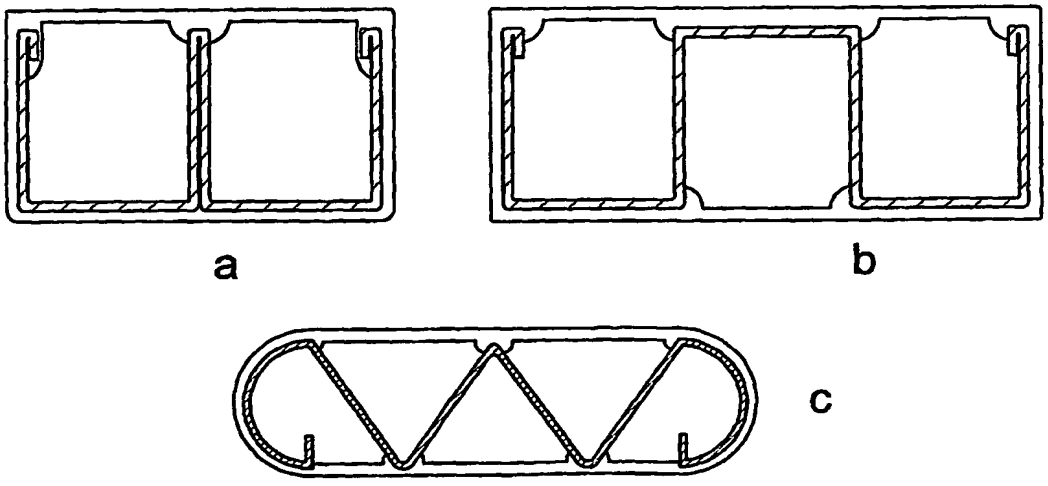

FIG. 6

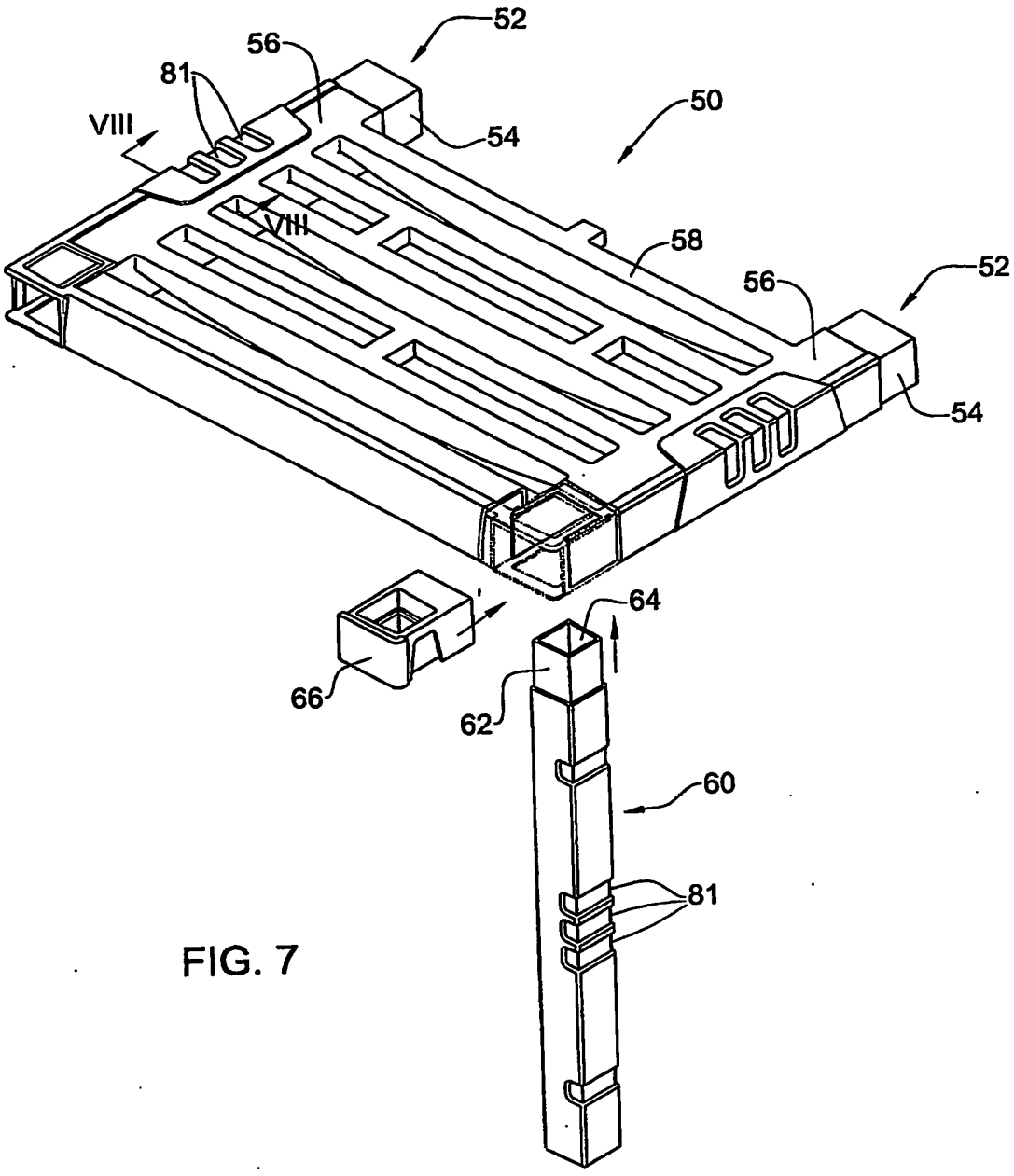

FIG. 7

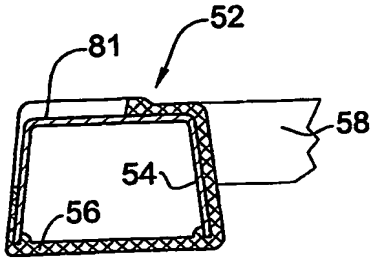

FIG. 8

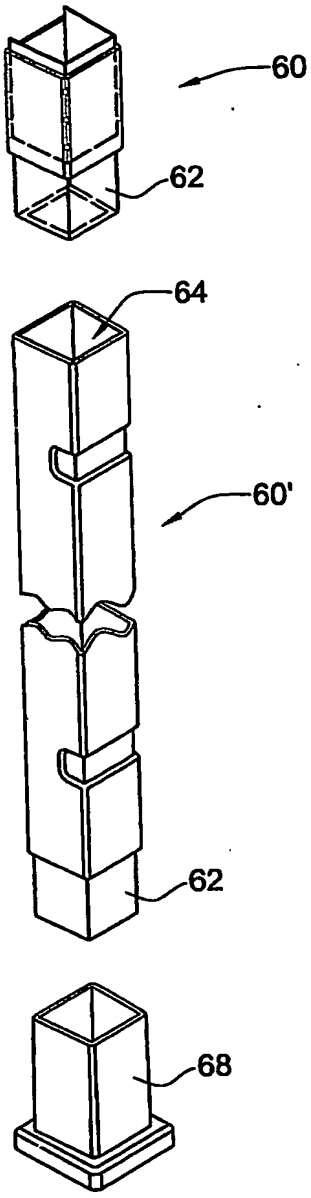

FIG. 9

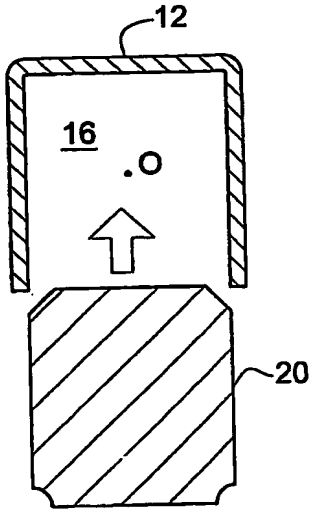

FIG. 10A

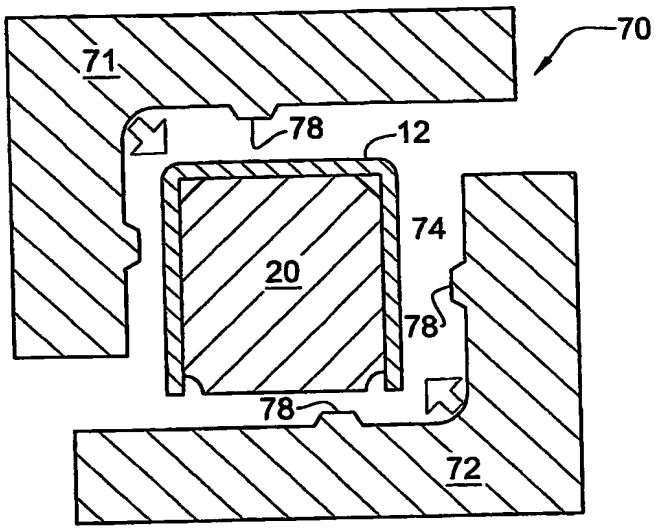

FIG. 10B

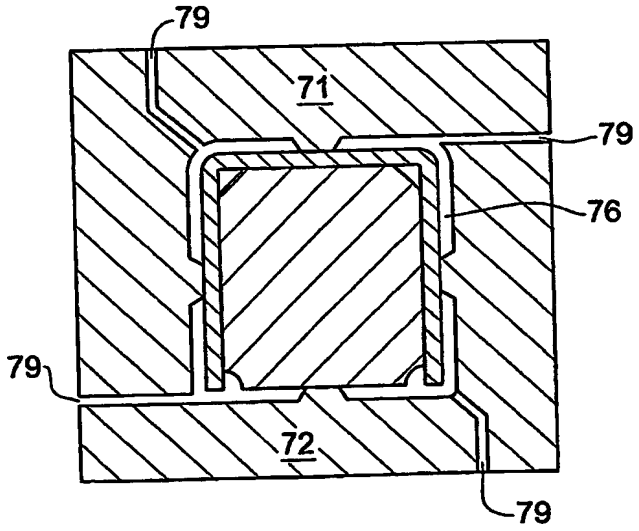

FIG. 10C

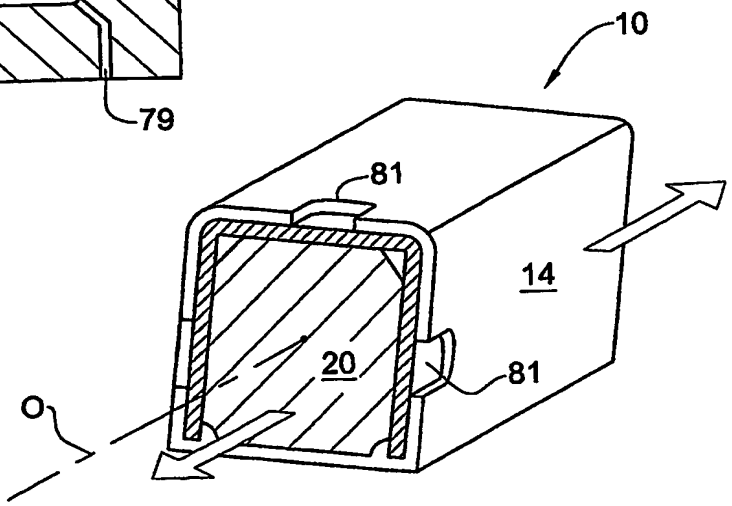

FIG. 10D

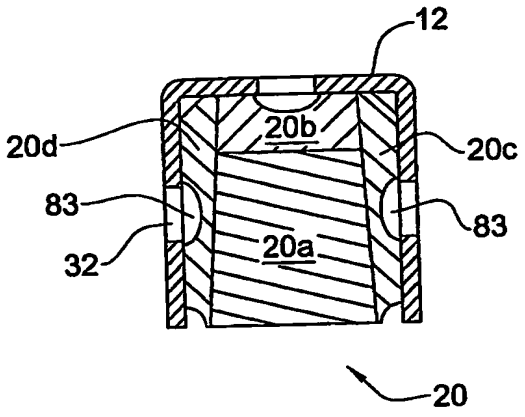

FIG. 11

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